MISCELLANEOUS.

172. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

If ϕ and ψ are small angles, show that an approximate value of ϕ/ψ is

$$\tfrac{2}{3}\frac{\sin\phi}{\sin\psi}+\tfrac{1}{3}\frac{\tan\phi}{\tan\psi}-\tfrac{1}{180}(\phi^2-\psi^2)(9\phi^2-\psi^2).$$

Solution by G. W. GREENWOOD, Dunbar, Pa.

$$A=\frac{\sin\phi}{\sin\psi}=\frac{\phi}{\psi}\left(1-\frac{\phi^2}{6}+\frac{\psi^2}{6}+\frac{\phi^4}{120}-\frac{\phi^2\,\psi^2}{36}+\frac{7\psi^4}{360}\cdots\right)$$

$$B=\frac{\cos\phi}{\cos\psi}=1+\frac{\phi^2}{2}-\frac{\psi^2}{2}+\frac{5\phi^4}{24}-\frac{\phi^2\,\psi^2}{4}+\frac{\psi^4}{24}\cdots$$

$$\frac{\tan\phi}{\tan\psi}=AB=\frac{\phi}{\psi}\left(1+\frac{\phi^2}{3}-\frac{\psi^2}{3}+\frac{2\phi^4}{15}-\frac{\phi^2\,\psi^2}{9}-\frac{\psi^4}{45}\cdots\right)$$

$$\therefore\ \frac{2}{3}\frac{\sin\phi}{\sin\psi}+\frac{1}{3}\frac{\tan\phi}{\tan\psi}=\frac{\phi}{\psi}\left(1+\frac{\phi^4}{20}-\frac{\phi^2\,\psi^2}{18}+\frac{\psi^4}{180}\cdots\right)$$

$$=\frac{\phi}{\psi}[1+\tfrac{1}{180}(\phi^2-\psi^2)(9\phi^2-\psi^2)].$$

The problem does not appear correct.

Solved in a similar way and with the same result by G. B. M. Zerr.

PROBLEMS FOR SOLUTION.

ALGEBRA.

301. Proposed by G. B. M. ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

A is at Philadelphia, B at Chicago. A's personal equation is e; B's is E. When a star crosses A's meridian at time t_1=8 hours, 33 minutes, 24 seconds, he presses a button, telegraphing the fact to B, who receives it at time t_2=7 hours, 43 minutes, 23 seconds. When it crosses B's meridian at time T_2=8 hours, 33 minutes, 10 seconds, he telegraphs A, who receives it at time T_1=9 hours, 23 minutes, 11 seconds. They now exchange places, and on the second day following, B observes the transit at time t'_1=8 hours, 33 minutes, 26 seconds, and A gets the information at Chicago at time t'_2=7 hours, 43 minutes, 25 seconds. It crosses A's meridian at time T'_2=8 hours, 33 minutes, 12 seconds, and B gets the information at time T'_1=9 hours, 23 minutes, 13 seconds. Find the difference of longitude between Philadelphia and Chicago.